

XIX.—NOTES ON THE EARLY STAGES IN THE
DEVELOPMENT OF THE DECCAN KILLIFISH
[*APLOCHEILUS LINEATUS* (CUV. AND
VAL.)].

(With 2 text-figures)

INTRODUCTION.

The sexual dimorphism and breeding habits of the Deccan Killifish, *Aplocheilus lineatus* (Cuv. and Val.) have already been discussed by one of us (Job, 1940). Its egg and a juvenile stage of 14.7 mm. have also been described. Observations on the early development of the fish made from eggs collected from natural habitat are detailed in the present paper. It may be pointed out that from the beginning of this century, when Aitken (1902, cited by Bannerman, 1910, p. 525) observed the larvivorous propensities of *A. lineatus*, the fish has attracted the attention of various workers, and several observations (*vide* Job, p. 52) point to its being of special value in anti-malarial campaigns, especially in the Deccan. Prashad and Hora (1936, p. 643) have emphasized that it is essential, for control measures to be successful, that the biology of the natural agent proposed for control work should be known in all possible details. It is hoped, therefore, that a thorough knowledge of the breeding and development of *A. lineatus* will prove helpful in the culture and use of this efficient larvivore, which is known to be of proved utility in mosquito-control.

In 1910 Willey (p. 122) wrote that *A. lineatus* lays eggs which become attached by glutinous threads to water plants, but added that he had 'not found them so attached', though he had seen them freshly extruded in the month of July. Again, Job's description of the eggs of the species was based on those laid in the month of May, 1938, under artificial conditions of the aquarium in which a few large-sized adult fish were kept.

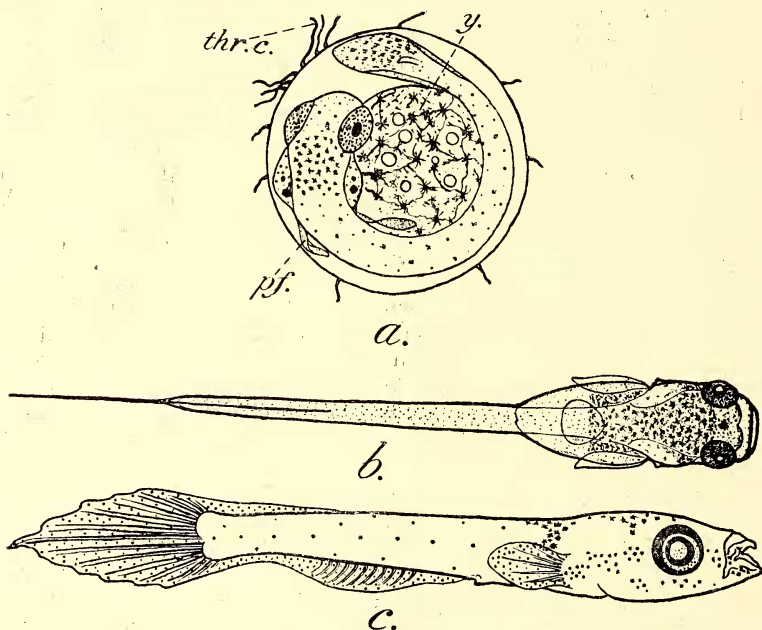
Search for the eggs laid under natural conditions was since then continued. On several occasions empty egg-cases were found attached to water weeds and roots of other aquatic vegetation. Young fry were found in the tanks and ponds in and around Trivandrum throughout the year. Eggs with healthy embryos were collected by one of us (S.J.) from the large tank in the Public Gardens, Trivandrum, in the month of September, 1939 and these were found attached singly to submerged bamboo sheaths near the margin of the tank by the tuft of anchoring filaments, which have already been described in detail by Willey (p. 122) and Job (p. 69). The eggs were carefully transferred to troughs of clean water and their development followed.

DEVELOPMENT.

The course of development of *Aplocheilus lineatus* is so similar to that of its North Indian congener, *A. panchax*, which was

recently described by one of us, that only some of the salient features in the development of *A. lineatus* need be described.

Embryonic stages.—The fairly large eggs are transparent during the early stages, but turn brownish as the development proceeds, owing to pigmentation within and accumulation of dirt outside the egg. The period of embryonic development is variable as was observed in the case of *A. panchax*, but usually lasts for about ten days. In the course of development the central mass of oil globules gets broken up; but the Kupfer's vesicle is not distinct as in *A. panchax*.



Text-fig. 1.—Developing egg and early larvae of *Aplocheilus lineatus* (Cuv. and Val.).

- a. Six days old egg \times ca. 22;
- b. Newly hatched larva (dorsal view) \times ca. 18;
- c. Larva of twelve days' growth (lateral view) \times ca. 14;
- p. f. pectoral fin, thr. c. cut ends of adhesive threads;
- y. yolk.

The six days embryo (text-fig. 1 a) is well developed with large pectoral fins which are kept in constant motion. The mouth and gill openings are present, the eyes are dark, the vitelline circulation is complete, the caudal fin bears rays and the embryo wriggles actively inside the egg-membrane. The embryo is seen to occupy a greater space within the egg-membrane than that in *A. panchax*. The nature of the hatchling depends on the period of incubation, the quantity of yolk being less in late hatching.

Metamorphosis.—In general appearance the newly hatched larva (text-fig. 1 b) of *A. lineatus* resembles very much that of

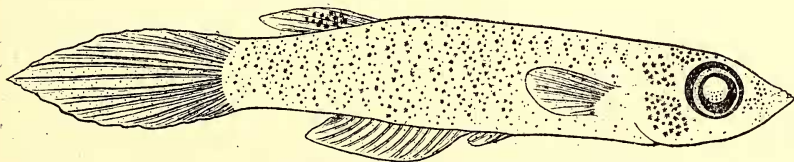
A. panchax, but exceeds the latter in length by about one millimetre. Some yolk-remnant with oil globules is present; the eyes are bright and shining, and the air-bladder is clear. The larva very seldom comes to the surface of the water. The pectorals, though without fin-rays, are large and functional. The caudal, which is lanceolate in shape possesses seven fin-rays, of which the third from above is the longest. All the median fins are continuous, and the dorsal and the anal are devoid of rays. The lower jaw extends slightly beyond the upper. The distribution of pigmentation is very much as in *A. panchax*.

A remarkable feature that has been noticed in the early larva of *A. lineatus* is its capacity to adhere to the smooth vertical sides of the aquarium by the antero-dorsal region of its head for fairly long periods. The usual position is oblique with the tail directed either obliquely upwards or obliquely downwards. Even a very careful examination has failed to reveal any special adhesive organ. Probably the adhesion is effected through adpression. The adhesive habit, however, lasts only for a couple of days after hatching. A more or less similar, though less apparent adhesive habit has also been observed in the case of *A. panchax* (Job, p. 64).

By the second day the larva makes more frequent visits to the surface. The yolk is reduced, the air-bladder becomes larger, and two more fin-rays are developed in the caudal fin.

In another day practically all the yolk is absorbed, and the larva moves about actively, feeding on minute organisms in the water at the bottom and on the sides of the aquarium. The air-bladder grows larger and extends further backwards. The chromatophores on the head turn brownish, while some of those between the eyes acquire a silvery lustre.

The main change that takes place within the next few days is in regard to the fins. The anal fin becomes gradually marked off from the caudal, and rays are formed in its posterior portion, which becomes broader. A week after hatching, the larva has fourteen rays in the caudal and ten in the anal fin. Text-fig. 1 c shows a twelve days old larva. It is about 7.5 mm. long. The protractile premaxillae have been protruded during fixation. Beginnings of as many as seven rays have appeared in the pectoral fin, while the number of rays in the anal has risen to eleven.



Text-fig. 2. Post-larva, 11 mm. long (lateral view) \times ca. 9.

(The magnifications given are those on reduction of text-fig. 1 to half and of text-fig. 2 to one-third.)

Text-fig. 2 shows a fish eleven millimetres long. The anal fin has fourteen rays and the pectoral about ten. The pelvics are well differentiated with the appearance of rays. The dorsal

ocellus is conspicuous. The occipital spot, however, is not yet well formed. This stage represents the final post-larval stage which grows and leads on to the 'young adult', 14.7 mm. long, described in the earlier paper (Job, p. 69).

SUMMARY.

Some of the early stages in the development of *Aplocheilus lineatus* are described. Eyed ova were collected from a natural habitat of the fish and hatched in aquaria. The salient features in the development of the species are more or less similar to those of *A. panchax*, but the Kupfer's vesicle is not distinct in *A. lineatus*, and the developing embryo occupies a greater space inside the egg-membrane. The characters of the hatchling with its peculiar habit of adhering to objects are described. The changes undergone by the larva in its growth up to the 11 mm. size are described. The 11 mm. size represents the final post-larval stage of the fish, after which it assumes the adult characters.

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XX.—BUTTERFLIES ATTRACTED BY MOIST EARTH.

On page 646 of volume xli No. 3 of the *Journal*, Capt. W. C. Carrot mentions coming across thousands of the butterfly *Appias nero galba* gathered on the sand near a stream. This peculiarity of collecting together in large numbers and sitting on damp spots and sucking up the moisture is a common occurrence with certain families of butterflies, though not of all species of some families. *Troides*, *Tros*, *Chilasa*, *Papilio*, *Pathysa*, *Zetides*, *Paranticopsis*, *Appias* and *Huphina* amongst others very commonly have this habit. But what is interesting about this habit is the reason for it. Why do these butterflies collect and suck at the damp earth in this way? The places at which they congregate are extremely local and cover a definite area small or large as the case may be,

¹ For further related literature such as Moody (1939), Stoye (1935), Mellen and Lanier (1935), Fraser (1938) and Innes (1939), see Job, 1940.